

# **Continued Development of Advanced Marine Vehicles by the South Florida Ocean Measurement Center**

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## **LONG-TERM GOALS**

This report is submitted by the South Florida Ocean Measurement Center (SFOMC) for collaborative marine vehicle research at SFOMC. It serves as an introduction to the separate reports for the two experiments conducted under this grant by SFOMC. A third section outlines range and infrastructure upgrades and support provided by the South Florida Testing Facility, a detachment of NSWC Carderock Division, and a partner in SFOMC.

### *Goals*

The US Navy has identified the enhancement of its littoral warfighting capability as a major priority. Clandestine rapid environmental assessment and mine reconnaissance are two very significant parts of that capability, with AUVs playing a crucial element in performing each of these tasks. These vehicles are an important technology for the Navy because they provide the ability to survey shallow water regions in a systematic manner, using a number of small, inexpensive, unmanned vehicles. The primary goal of this project was to provide additional specific AUV capabilities resident at SFOMC for related Navy projects that support specific analyses and experiments to further Navy ocean technology and scientific capabilities. The secondary goal was to provide the scientific community with a natural ocean observatory and an enhanced infrastructure within which to conduct these types of experiments.

## **OBJECTIVES**

This report references two scientific experiments that were carried out on the SFOMC Range. In order to comply with report size and format constraints, the following two experiments are reported one in more detail by the individual PIs.

The two experiments were:

1. *Continued Enhancement of Autonomous Marine Vehicles*: The objective was to investigate basic and applied problems associated with the performance effectiveness of reconnaissance of littoral waters in support of mine warfare and oceanographic tasks. The Principal Investigator for this task was Dr. Edgar An, FAU. A separate report is being submitted for this task.

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**2. Modeling and Evaluation of Bi-Static Tracking in Very Shallow Water:** The objective was to improve passive acoustic tracking capabilities in shallow water by extending the concepts developed to date for the ANS sonar system, and to develop an acoustic model for AUV mission planning and data assessment. The Principal Investigator for this task was Dr. Stewart Glegg, FAU. A separate report is being submitted for this task.

**3. South Florida Testing Facility Industrial Support And Infrastructure Improvements**

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SFTF is a detachment of NSWCCD. SFTF operates its range on behalf of the SFOMC partnership. In addition to SFOMC, SFTF operates its range in support of a full spectrum business base of full-scale Navy related Test & Evaluation. SFTF performed the following tasks in support of the FY 02 SFOMC program.

*Multiplexers (FAU and NSWCCD) Upgrade, Repair, and Integration:* The Principal Investigator for this task is Dr. William Venezia, Chief Engineer at NSWCCD's South Florida Testing Facility (NSWC-SFTF).

NSWC-SFTF has accepted responsibility for the maintenance, repair and operation of the FAU multiplexer. Towards this end, in June of 02, NSWC formed a technical working group comprised of NSWC and FAU engineers and technicians. Work has begun to harden the system for extended deployment, make the system more robust and useable, write a complete operations manual with a clearly defined user interface, and to improve the diagnostics capability. "Smart" dummy plugs have been ordered that will allow in water testing of each user port prior to plugging into the system. The system is repaired and operational but is still outside of the pressure vessel. In this state the multiplexer is undergoing final upgrades and dockside system testing. The existing high voltage, small diameter electrical-optical sea cable is now augmented with a new 18,000-foot long large diameter harbor defense cable. This power cable was purchased, terminated, and laid by NSWC-SFTF in July. The system is scheduled for a November 02 deployment.

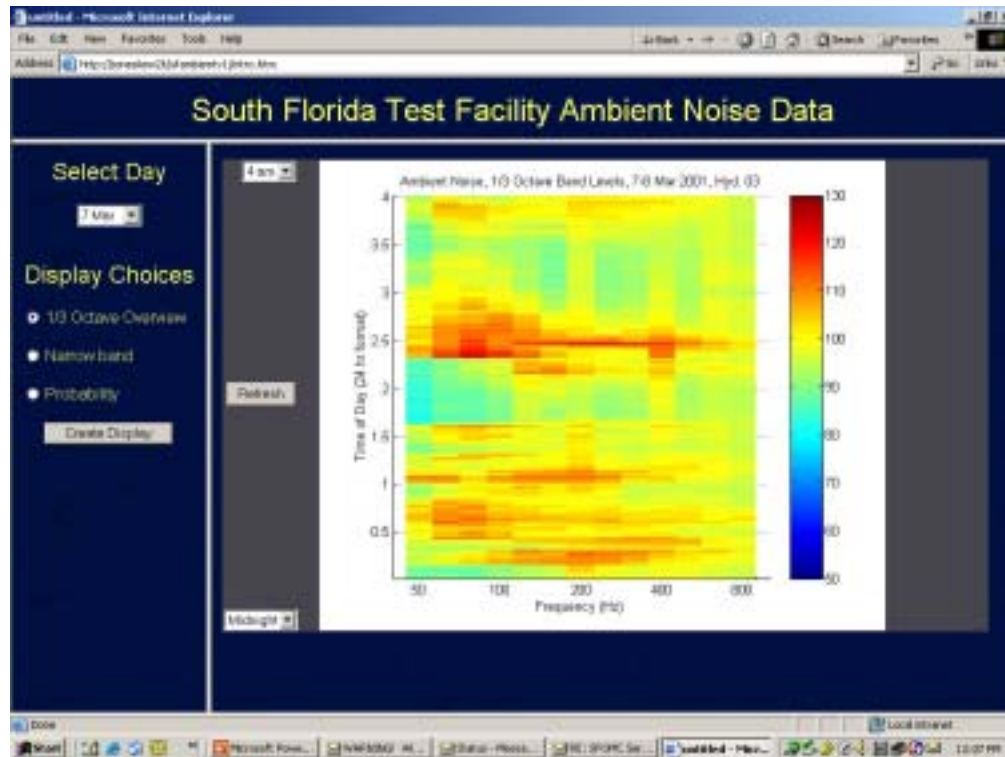
*Data Management:* The Principal Investigator for this task is Dr. William Venezia, Chief Engineer at NSWC-SFTF.

NSWC-SFTF has taken responsibility for the FY 02 as well as pertinent previous years' SFOMC experiments' data management. This function includes compiling documentation of quality verification, Internet display where appropriate, and archival of the data collected by the Principal Investigators. NSWC-SFTF provided to the principal investigators geographical information data quality assurance (target and sensor locations) and documentation on past, present, and future installations.

A variety of servers are now running in a developmental mode. Real Time Data Server is located at <http://sftf.dt.navy.mil/real.htm>. This server is now providing real time data from all existing in water

sensor systems. This data server is running behind the NSWC Firewall along with all the other servers except SFOMC.org. Migration of the servers out from the firewall is in progress. The new Linux Server to host DODS (Distributed Oceanographic Data System) is located at <http://157.187.144.045>. This server is running in test mode with a free form data server.

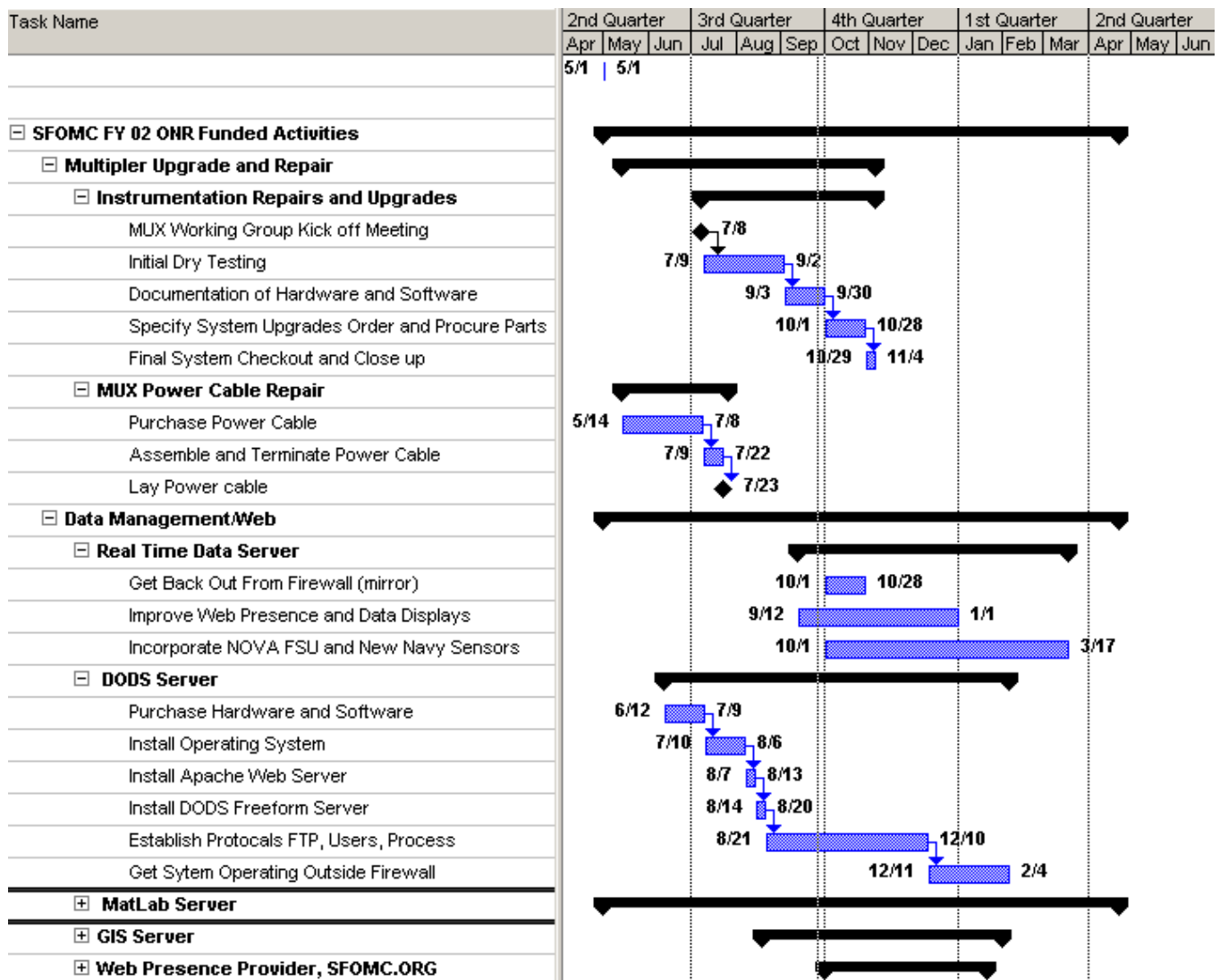
The MatLab and GIS server is located at <http://157.187.144.33>. The MAT LAB based server is now running user queries and graphical interpretations of acoustics transmission experiments including display of ambient noise. A sample screen grab from this server is shown below.



The GIS server is not yet running. The SFOMC Web Presence Provider [www.sfomc.org](http://www.sfomc.org) currently administered by FAU is being transferred to NSWC CD. This will allow for rapid updates and incorporation of recent events and links to sponsors and points of interest related to the ONR sponsored research.

A Data Management and Quality Assurance Master Plan is being developed to incorporate all the data generated by this experiment, as well as pertinent data from previous year SFOMC experiments, and to set up a format and process for a sustaining, secure process for management of both experimental data and geographical information.

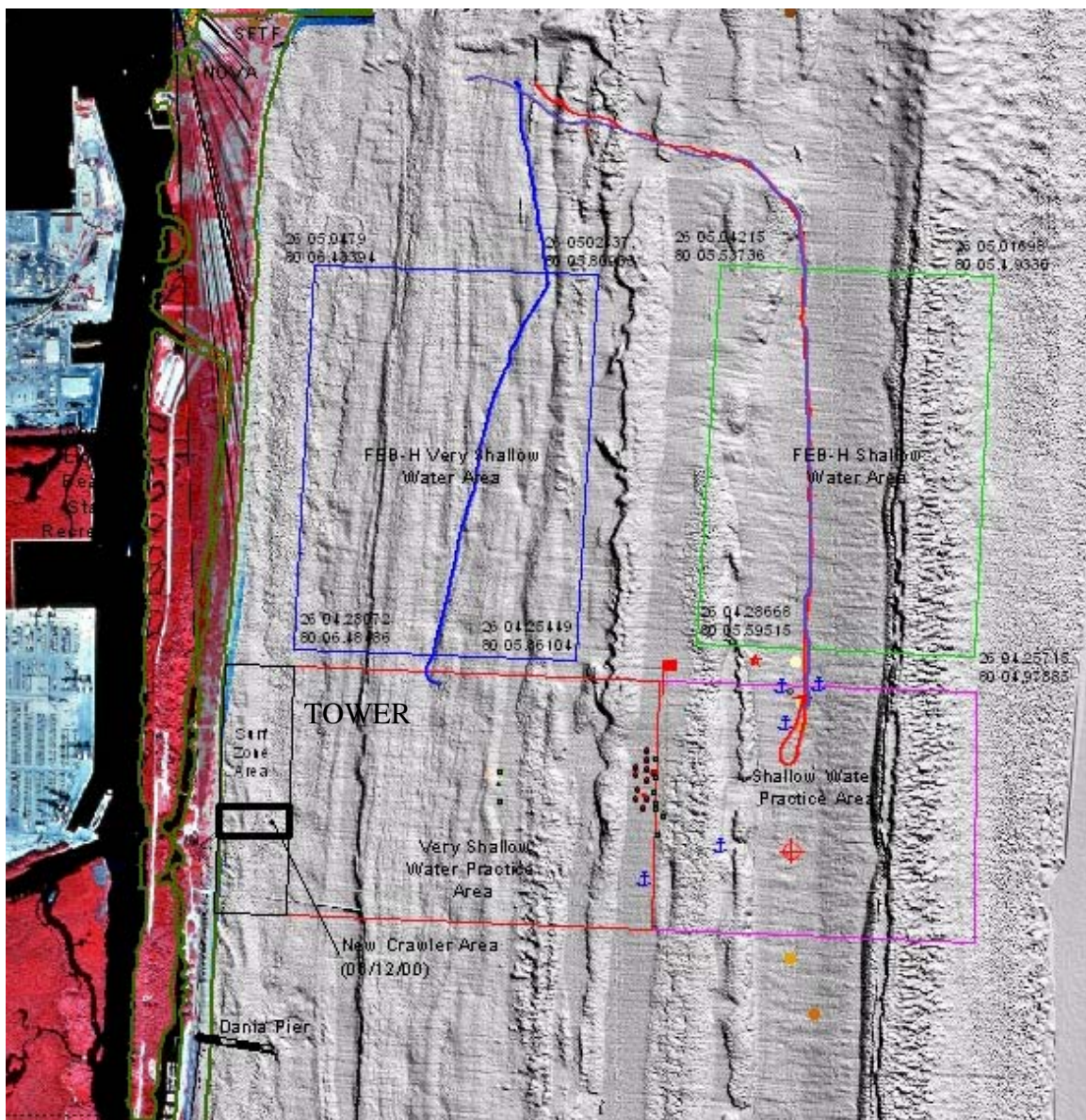
Activities related to the multiplexer repair and upgrade and data management to date are illustrated on the following Gantt Chart.



**Industrial and Facility Support:** The Principal Investigator for this task is Dr. William Venezia, Chief Engineer at NSWC-SFTF.

NSWC-SFTF provided industrial and facility support to all activities contained in the overall FY 02 SFOMC proposal to varying degrees. During on range testing NSWC-SFTF provided test support including all communications, surfaced tracking (radar, GPS, automatic optical) and some limited submerged tracking. NSWC-SFTF provided acoustic and non-acoustic support for the FY 02 SFOMC experiments including repair and upgrade of existing sensors. Towards this end NSWC CD SFTF has purchased 100,000 feet of power cable to date 30,000 feet of this cable has been laid. 18,000 feet of cable was laid to repair the multiplexer and 12,000 feet to install a new meteorological oceanographic fixed platform to support the acoustic communications experiment. These cable lays are shown below.





The new tower (cable lay shown above) will support a variety of sensors including both acoustic and non-acoustic. To date the tower has been designed and the materials ordered. Installation of the tower is planned for November 02 at the same time the multiplexer is deployed.

Industrial facilities support included support of ONR sponsored activities on range and in the vicinity of the range. This support has included environmental compliance assistance for activities both on and off the range and off the NSWC-SFTF range. The following table summarizes the activities of the primary vessels used to date. In addition, 4 days of commercial vessel time was used to lay the cables describe previously.

	Range Ops And Range Related Note 1	Range Ops Not Range Related Note 2	Ops Off Range Note 3	Total Days
R/V Stephan	40	7	51	98
R/V Oceaneer IV	10	6	20	36
R/V Lee	2	1	7	10
Total	52	14	78	144

Note 1 - On SFTF Range (OE research, SFOMC tasks, NSWC support)

Note 2 - On Range, non-research related (academic instruction)

Note 3 - Ops conducted outside the SFTF Range